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ABSTRACT

The document analyzes economic factors that might cause the output of educational services to diverge from the theoretical optimum because of a divergence between marginal social valuation and marginal social cost. Education contains both investment and consumption aspects. The analysis shows that the only distortion resulting from uncertainty arises because information is a public good whose supply should be increased: there need be no distortion attributable to "capital market imperfections"; all else being equal, current tax laws encourage relatively too much educational investment in human capital. Additionally, the educational services market is in disequilibrium because the education boom of the 1960s left it with a large fixed investment in buildings and many tenured teachers; a mother's education importantly affects her children's future success, the father's less so, but the present value of this future intergenerational transfer is small. Tentative conclusions indicate an increase in social subsidy of education is justified and should be directed to grade schools. An 18-item bibliography is included. (Author)

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NOTES ON DISTORTIONS IN THE MARKET FOR EDUCATIONAL SERVICES

by

Lawrence S. Olson

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Analyzes economic factors that might cause the output of educational services to diverge from the theoretical optimum, due to a divergence between marginal social valuation and marginal social cost. Education contains both investment and consumption aspects. The analysis shows that (1) the only distortion due to uncertainty arises because information is a public good whose supply should be increased; (2) there need be no distortion attributable to "capital market imperfections"; (3) all else equal, current tax laws encourage relatively too much educational investment in human capital. However, (4) the educational services market is in disequilibrium because the education boom of the 1960s left it with a large fixed investment in buildings and many tenured teachers. (5) A mother's education importantly affects her children's future success, and the father's less so, but the present value of this future intergenerational transfer is small. Tentative conclusions: An increase in social subsidy of education is justified and should be directed to grade schools. 24 pp. Bibliog. (MW)

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NOTES ON DISTORTIONS IN THE MARKET FOR EDUCATIONAL SERVICES

Lawrence S. Olson

I. INTRODUCTION

The demand for educational services is a derived demand, since education is a good (containing both consumption and investment attributes) that is produced by a student using his own time and educational services (Nerlove 1972, p. S 181). The cost of any increment to an individual's stock of education includes direct outlays (tuition, books, fees, and any room and board expenses beyond those which would have been incurred otherwise) and indirect costs (the value of earnings forgone) (Becker 1964, p. 75).

Various factors have been cited as causing the output of educational services provided to diverge from the theoretical optimum. The purpose of this paper is to separate fact from fiction regarding these factors. The discussion is relevant to education; however, many of the results apply equally well to other types of human capital (e.g., on-the-job training), so, although speaking only about educational capital, I often use the broader term, human capital.

A distortion is defined as a divergence between marginal social valuation (MSV) and marginal social cost (MSC). By driving a wedge between supply and demand, they set up incentives for the output of the distorted industry to diverge from its optimum.

By subjecting previous work to a theoretical analysis in Sections II and III, I attempt to show that the two most mentioned distortions toward "too little" output of educational services are at least partly evanescent. In Section IV, I examine the standard Harberger analysis of distortions in the capital market due to depreciation. His assumption that tax-induced distortions in the market for human capital are insignificant makes his treatment incomplete. Section V contains a discussion of distortions due to disequilibria in markets for factors used in producing educational services. In Section VI I discuss and catalogue the externalities attributable to education. Finally I make a few comments about subsidies to education.

This paper is primarily theoretical and I attempt no systematic empirical study. However, I occasionally cite fragmentary evidence and will attempt to indicate what types of data would be needed to give empirical tests of the theoretical framework.

II. UNCERTAINTY

In education a frequently mentioned distortion toward "too little" output is attributed to uncertainty. A fairly typical treatment of the effect of uncertainty on the social rate of return to education can be found in Nerlove's 1972 paper in the JPE supplement. "To the extent that the risks associated with investment in...education can be pooled away... they are <u>private</u> but not <u>social</u> risks." Since most people are risk averse, "rates of return to investments in...education will have to be higher than to other, less risky, investments." On this count "too little" investment

in education will be made (Nerlove 1972, pp. S 186, 187, emphasis in the original). There are at least two fallacies contained in this argument: the implicit assumption that uncertainty must increase as a result of additional investment in education and the assertion that private and social rates of return differ because of the absence of pooling.

To see why the assumption of increased uncertainty need not hold, one need only examine the character of the investment being considered. An individual deciding whether to seek an additional year of schooling must compare the income stream (net of all direct costs) he would receive with his current education and the one he would receive with one more year of schooling. Since both alternatives are stochastic, there is no necessity for the stream with the additional year to involve more uncertainty. In fact, I have found some evidence that, assuming constant relative risk aversion (in which case risk is measured by a value akin to the coefficient of variation of returns) uncertainty is lower for individuals with higher levels of schooling (Olson 1973b, Tables 3-5). Unemployment rates typically fall as schooling level rises; therefore, it seems possible that an increase in education may actually reduce private risk. If lack of risk pooling drives a wedge between private and social rates of return to education, it need not cause social rates to exceed private rates. For instance, suppose that pooling reduces risk by the same proportion at all educational levels. Then results from my paper and from unemployment rates imply that the social rate of return to marginal increments to education falls short of the private rate by a factor times the change in the poolable segment of the proportional risk premium. Therefore, any failure to pool risks can mean too much, rather than too little, investment in education.

Lack of pooling need not be distorting. The allegation of a distortion implies that risks can be pooled without introducing any further distortions. Risk certainly causes real disutility if people are risk averse, so there is a social cost to the poolable component of risk. If, however, the pooling of risks introduces a social cost as large as or larger than the one it removes, it can hardly be said to bring the system closer to an optimum. It will be my assertion that the above situation does in fact obtain and, therefore, no distortion exists in the typical case where risks are not pooled. As Schultz (1971b) shows, the difficulty arises because costs of and returns to schooling contain both monetary and psychic components. In general, only the monetary component can be pooled (by insuring); therefore, given the large psychic component, any insurance scheme introduces "moral hazard." To the extent that substitution between these components is possible, insurance would cause a distortion. Insurance against abnormally high costs would cause substitution of monetary for psychic costs (e.g., people hiring tutors rather than digging through frustrating material). Similarly, insurance against abnormally low returns would cause substitution toward psychic and against monetary returns. The latter possibility is particularly important for women. Under a full insurance scheme, women could be expected to work less and spend more time raising children or visiting art galleries. Although they are smaller, long-run substitution possibilities for men are probably also substantial.

Calculated risk premiums (using "reasonable" values of the parameters) are not generally very large (Weiss 1972). It is my assertion (as yet

unproved) that the distortion that would be caused by risk pooling is very large indeed. Values of the long-run elasticity of substitution between monetary and nonmonetary components would be necessary to check on the validity of this assertion. If the assertion is true, the existence of poolable risks does not distort the choice between education and alternative investments. (Some information on the size of the substitution elasticity for a select group will become available as the Yale Tuition Option Program continues in operation. I anticipate that the money earnings of those heavily covered by that program will be less than the earnings of similar individuals whose educational capital is uninsured.) Even if the existing risk premiums on poolable risks are larger than the social costs of pooling (a possibility I consider highly unlikely), the above analysis would serve to attenuate any "distortion" due to poolable risks.

There is, however, a distortion in the market for educational services attributable to uncertainty. It arises because the root cause of uncertainty is lack of information. To the extent that information has attributes of a Samuelsonian public good, its production by the private sector will tend to be "too small" and people will be subject to an unnecessarily large amount of uncertainty. Since this difficulty can be removed by inexpensive (relative to the benefit) information gathering by the government or by a small (relative to the benefit) subsidy of private information, it qualifies as a distortion. It is, then, appropriate for information gathering to be increased to the point where MSV (totalled over all relevant persons for the part that is a public good)

equals MSC. As the amount of information available to the public is increased, the quantity of educational services purchased may increase or decrease. For example, an increase in information may increase the relative return to activities requiring less education. That is, the proportion of potential "public" information now available may be smaller at lower education levels. The converse is also possible, so the direction of the effect of this distortion is unclear.

Estimation of the size and sign of this distortion would require data on the proportion of information that has the attributes of a public good and on the degree of information currently being provided at different levels. Such data would be difficult to obtain. Some indication could be gained from comparison of the imputed gains to persons using a public (or private) counselling service--aggregating over groups when it appears that the information supplied is applicable to more than a single person--with the costs of providing the service. Such counselling services are available only for those who have completed at least part of their high school training (where they are counselled about the perils of "dropping out"). However, the majority of our population reaches at least that level, so the relevant margin of choice is covered.

III. "CAPITAL MARKET IMPERFECTIONS"

Friedman first made the allegation that there is a distortion due to "capital market imperfections" in 1955, and it has been part of the economics of education ever since. He argued that the legal prohibition on the sale of human capital (slavery) implies that the rate of interest

charged on loans to finance investments in human capital would be unnecessarily high, causing "too little" investment in education (1962). However, under very reasonable assumptions this argument doesn't hold up. In any case, if the distortion exists at all, it is probably much smaller than Friedman implied.

The fallacy in the above argument is easily uncovered by an examination of the cause of the extra interest charge to which Friedman alludes. Assume that a physical capital (PC) asset can be found with the same "real default risk" as any given human capital (HC) investment. "Real default risk" is defined as the probability that the net present value (NPV) of future returns on the asset will at some point in time fall below the NPV of required future payments on the loan (that the owner of the PC asset would default on his loan and allow the asset to be repossessed). The interest rate charged on the PC asset will reflect this risk. Let i = the riskless interest rate and r_{rd} = the default premium due to the expected loss from the real default risk. The rate charged on the PC asset will be $r_p = i + r_{rd}$, but the rate charged on a comparable HC asset will be $r_H = 1 + r_{rd} + \rho$. The inclusion of ρ reflects two facts. First, when the owner of HC defaults on his loan, repossession is illegal. Therefore, he will default not when NPV(payments) > NPV(returns) but when NPV(payments) > NPV(default costs), where default costs include both money and psychic costs (e.g., the cost of a bad credit rating). It will be assumed (although it is not crucial to the argument that follows) that NPV(default costs) < NPV(returns), so the probability of default will be greater for HC. The other factor contributing to ρ is the extra loss incurred by the lender in the case of default since HC cannot be repossessed.

Since ρ is caused by government edict, it could theoretically be removed; if it makes effective interest costs larger for HC than for similar PC, it qualifies as a distortion. However, since ρ is a default premium (similar to r_{rd}) it need not increase expected interest costs. Sufficient conditions for any default premium to be nondistorting are that (a) either lenders are risk neutral or risks are "diversifiable," (b) expected losses on which the premium is calculated are estimated without bias, and (c) r_H does not exceed the maximum legal rate if there are applicable usury laws.[1] Given these assumptions, the effective interest rate for both the PC and HC investments is the riskless rate i, since this rate reflects expected payments. In this case, there is no "capital market imperfection" and no distortion. If conditions (a), (b), or (c) are violated there can be a distortion. If condition (b) is violated the direction of the distortion is unclear. When the probability of default is overestimated by the same degree or when overestimation is greater for HC, relatively "too little" investment in HC will be undertaken. If the degree of overestimation is sufficiently larger for PC than for HC (sufficient to overcome the extra term ρ in r_H) there can be relatively "too little" investment in physical capital. The opposite applies to all statements about condition (b) if the bias is toward underestimation. Thus, no clear direction of bias emerges if condition (b) is violated. If condition (a) is violated by risk aversion of the lender or by an equal degree of difficulty in diversifying away from risk (a broadly reasonable assumption), the result will be relatively

[1] Condition (c) was brought to my attention by John Koehler.

"too little" investment in HC. If condition (c) is violated, either by r_H exceeding the applicable maximum (the maximum is enforced on loans of this type) and r_p falling short or by both r_H and r_p exceeding applicable maxima there will be a distortion toward relatively "too little" investment in HC. Note, however, that violations of conditions (b) and (c) are "second order" effects and can be expected to be smaller than if all of ρ represented a distortion. Violation of condition (b) may counteract violations of (a) and (c), since it may push toward "too much" investment in HC.

Estimation of the magnitude of any distortion due to capital market imperfections would require data on the net increment to portfolio risk (in Fama's sense) caused by addition of various types of HC and various types of PC to a "typical" lender's portfolio. Similarly risky assets of HC and PC could be matched using these estimates. Armed with data about default rates on loans to finance the different assets, on the costs incurred by the lender due to default on loans secured by PC assets (and assuming that lenders lose the entire NPV of payments when human capital loans are defaulted) and on the nature and degree of enforcement of applicable usury laws, one could determine whether or not r_{rd} and ρ represent pure, unbiased default premiums.

IV. DEPRECIATION AND HUMAN CAPITAL

The discussion of distortions in the capital market due to depreciation has concentrated primarily on the question of how the tax system distorts the margin of choice between assets of different lives, rather than on how it affects the total supply of capital. Most treatments assume that the

supply of saving is highly inelastic. In support of this assumption, authors cite the fact that the marginal propensity to save has been roughly constant in most societies over long periods despite large changes in tax laws. This fact is not conclusive, however, since any elasticity estimated in a time series contains income effects. Attempts have also been made to estimate the pure (substitution-effect-only) price elasticity, and fitted values are quite small, on the order of 0.2 or less (Harberger 1963). Later in this section I will show that even a zero elasticity of saving does not prevent distortion between the total amount of HC versus the total amount of PC. A basic theoretical result, central to later arguments, is that there are two methods of assuring that the margin between investments of different lives remains undistorted. (a) Charge proportional taxes on all returns and allow full write-off of all capital costs. Letting t be the tax rate, this makes the government a t-percent partner in each investment. Rates of return and thus ordering of investments by rate of depreciation are not affected under this method. (b) Rather than writing off capital costs immediately, allow a series of depreciation write-offs, the NPV of which (evaluated at the appropriate discount rate) equals the NPV of the stream of true depreciation. The ranking of investments with different rates of depreciation is not affected by this method, but note (and this is important for some later results) that the average rate of return is affected. The rate of return net of taxes is equated across assets (Harberger 1963), and in this system that rate of return will be lower than the gross rate by the effective rate of tax, t. That is, if under method (a) the average rate of return was r, under method (b) the average rate would be r(1-t).

Both the economics of education literature and the writings of public finance specialists have tended to ignore the effect of tax laws on the total stock of HC and the average rate of depreciation of that stock. Harberger, for instance, defends his reluctance to include distortions due to depreciation of HC in an analysis of tax distortions on capital and labor (1968) by noting that the portion of educational costs in the form of forgone earnings fits under method (a). Since most of the costs, at least of college education, are in this form, he implies that the distortion of depreciation rates in HC is small relative to that for PC and can therefore be ignored. However, there are a few problems with this rationale.

(1) The portion of HC costs that is forgone earnings is large for education (say 70-75%). However, method (a) requires that tax rates be proportional so that the proportion of costs borne by the government equals the proportion of benefits appropriated. The actual income tax system is progressive, however, and (since forgone earnings costs are generally borne by the student rather than his parents) the tax rate at which costs are written off is smaller than (say, half as large as) the rate at which returns are shared. For example, if 70 percent of costs are forgone earnings, only about 35 percent are effectively charged off per method (a). Distortions among educational types with different depreciation rates are thus given full sway for more than 50 percent of the costs of HC. For this portion, longer-lived HC is discriminated against.

(2) At first glance it appears that education is a relatively homogeneous good, but deeper inspection shows that there is a substantial range in the expected depreciation rates of different types of education. Examples of short-lived HC are knowledge of a computer language that is subject to obsolescence, of technical skills tied to a single model of PC equipment, and of particular tax or accounting systems. Examples of long-lived educational capital are knowledge of the three R's, of the rules of logic, and of basic economic theory. So there is much room for discrimination. The user cost of education type j is given by $U_j = NPV_j(r + \delta_j)$ where r_j is the interest rate, NPV is its net present value (or market price if it is salable), and δ_j is its (assumed exponential) depreciation rate. Taxes are charged on the entire user cost, inclusive of δ. For example, if δ_j is 1% for basic reading skills and 20% for knowledge of a particular tax system and r is 10%, the user cost on the former would be 11% of its asset value, and on the latter it would be 30%. Further, it appears that depreciation of HC is not independent of its use, although the dependence is in the opposite direction of that for PC. Recent studies find that HC that is used depreciates much less rapidly than HC that is not used (Polachek 1972). (PC depreciates more rapidly with use, although studies typically ignore this fact.) For this reason the educational capital of women would be discriminated against relatively, other things equal. Thus, there is a substantial possibility of discrimination between HC assets with different δ's.

If one is speculating on the relative distortions within PC versus those within HC, an interesting question is whether the dispersion of δ's is larger for HC than for PC. My impression is that there is more dispersion in δ's for PC, although this impression rests entirely on evidence of the range of asset lives available and is only an indirect indicator of dispersion. The range of δ's for HC is necessarily smaller because there can be no HC equivalent of the Hoover Dam or the Suez Canal. However, since depreciation rates for these super-lived PC assets are effectively zero, whereas the longest-lived HC assets have depreciation rates of about 1%, the difference in user cost will be small. Thus, even though dispersion is probably greater for PC, the larger dispersion says relatively little about the probable relative effect of tax-induced distortions.

(3) Tax treatment of depreciation on PC assets generally amounts to a poorly applied version of method (b). There is no write-off of investment costs; instead companies are allowed to make a deduction from their taxable income in later years to offset depreciation. These depreciation write-offs vary by category of equipment, but their correlation with true depreciation costs is not strong. But note that they apply to all of each PC asset whereas, as stated above, less than 50% of the cost of the average HC investment is written off in accordance with method (a). It is clearly not unreasonable for tax-induced distortions due to depreciation to be greater across types of HC than across types of PC.

(4) Assume that NPV(write-offs) = NPV(true δ's) for each type of PC, and that all of the costs of HC are written off per method (a). In

this case there is no distortion due to taxes on δ within PC or within HC. There is, however, a distortion between total PC and total HC, because the effective rate of return to HC is not altered and that to PC falls to $r_p' = r_p(1-t_p)$ where t_p is the effective tax rate on PC. In a well-functioning capital market, this difference will be removed by an expansion of total HC relative to total PC.[1] Relaxing the above assumptions, however, may reduce this distortion. The effect of allowing only partial write-off of HC costs is to lower the rate of return to schooling to $r_H'' = r_H\left(\frac{1 - t_H}{1 - \epsilon t_H}\right)$ where ϵ is the effective proportion of HC costs written off under method (a) and t_H is the effective tax on HC returns.[2] For example, if $t_H = .3$ and $\epsilon = .5$, then r_H'' becomes $r_H \frac{.7}{1 - .15}$ or $.82r_H$. The effective tax rate on physical capital (t_p) will generally exceed the average tax rate charged to owners of human capital, since the portion held by corporations is subject to double taxation. Profits are taxed once under the corporate income tax and again when they are distributed to shareholders as dividends or capital gains. Thus, letting $t_p = .5$, we get $r_p' = r_p(.5)$ and the presumption is toward relatively "too much" investment in HC. Removal of the assumption that NPV(δ) = NPV(δ write-offs) for PC will also change the overall distortion, but the direction

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[1] This fact was brought to my attention by A. C. Harberger.

[2] Assume, as Mincer does (1972) that portion of earnings due to schooling rises immediately after the completion of schooling to a constant level, which continues until retirement. Assume infinite life. Then an investment in one more year of schooling having costs C and a perpetual stream of increased earnings R will have the rate of return $r_H = \frac{R}{C}$ in the absence of taxes. Adding taxes and setting $\epsilon = 1$--i.e., all costs subject to write-off--this rate of return becomes $r_H' = \frac{R(1-t_H)}{C(1-t_H)} = r_H$. With $\epsilon < 1$, so that ϵ% of costs are written off, it becomes $r_H'' = \frac{R(1-t_H)}{C(1-\epsilon t_H)} = r_H\left(\frac{1-t_H}{1-\epsilon t_H}\right)$.

of the change depends on which of the NPV's is larger. I have no a priori expectation, and in any case the difference is not likely to be large on average over all PC.

The general conclusion from this section is that there is no theoretical necessity and apparently no strong empirical expectation that within-class, tax-induced distortions due to depreciation will be greater for PC than for HC. There is, however, a clear expectation that, with respect to depreciation tax laws, there is a distortion toward "too much" HC relative to PC. Therefore, ignoring HC in treatments of the effect of taxes on resource allocation within the total capital market is not justified, and errors thus committed may be very large.

It is quite difficult to get an empirical handle on the theory outlined in this section. At a minimum one would need to know the mean and variance of effective tax rates and δ's for PC and HC and the proportion of shared costs for types of HC with different δ's. To calculate the distortion within HC between women and men one would need to know the proportionate decrease in the δ of HC when it is used and how that proportion changes for different types of HC.

V. DISEQUILIBRIA

Normal treatments of distortions tend to ignore disequilibria, seeking divergence between MSV and MSC only in the long run. For most types of problems this is appropriate because movement to final equilbrium is relatively swift and disequilibrium paths are difficult, if not impossible, to predict accurately. Certain characteristics of education cause adjustment

to be slow and the path to be fairly predictable (at least qualitatively). These characteristics arise because of the relatively large proportion of costs of educational service that is fixed and because fixed costs in the form of buildings and tenured faculty are predetermined for long periods of time. A tendency for disequilibria to persist and for dynamic paths to be incremental (only a portion of the discrepancy is removed in any year) is built into the system, giving rise to substantial and long-standing distortions. This source of distortion has current relevance since the strong market for educational services of the 1960s encouraged building programs and the granting of tenure to large numbers of faculty, almost surely resulting in spatial misallocation of resources in the 1970s and perhaps in a general oversupply of buildings and older faculty.[1] In either case there would be a tendency to use these factors of production in amounts such that their MSC exceeded their MSV. "Too much" of these factors of production would be used causing "too little" of substitute factors to be used at any given level of output of educational services.

The direction of the effect on the overall level of educational services is clear although its magnitude is not. If these disequilibria raise the price of educational services they cause a force toward relatively "too little" output. If, however, they are treated by the producer of educational services as pure fixed costs (in line with the maxim "sunk costs are sunk") and do not affect the price of educational services to purchasers, they will only cause distortions in the factor markets and have no effect on the overall production of these services. The truth probably lies somewhere between these extremes, so the existence of disequilibria

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[1] I owe this point to T. W. Schultz.

probably results in some distortion toward "too little" production of educational services.

Empirical verification of the existence, size, and permanence of the disequilibria discussed above and the degree of distortion they cause would require extensive study. Questions of the spatial allocation of supply and demand, of the returns attributable to particular factors that enter joint production, of the elasticity of substitution between oversupplied factors and other factors, and of the speed of adjustment would all need to be answered.

VI. EXTERNALITIES

I have little that is new and exciting to say about externalities attributable to education. I shall simply list some of those that have been noted and try to give an indication of their probable magnitude. The signs of all externalities discussed below are positive. That is, their existence points toward the possibility of "too little" investment in HC.

Purely pecuniary externalities include lower levels of unemployment benefits and welfare payments for those with more education. These external benefits may be quite large. For example, in 1971, unemployment rates were 5.1 percent for whites with four years of high school and 3.0 percent for whites with four years of college. Similar figures for nonwhites are 8.8 percent and 4.6 percent. (US Department of Labor, 1972.)

The main purely nonpecuniary externalities usually cited are the making of better citizens (a claim about which I am wary) and general literacy. Almost by definition it is impossible to give probable magnitudes to these with any accuracy, but at least the margin of choice in

education is above the basic literacy level for most US citizens. Thus, although a benefit is conferred, no relevant margins are distorted.

Some externalities of education have both pecuniary and nonpecuniary aspects. For instance, there is a complementarity of graduate training with basic research. This has both pecuniary (lowered costs in technology-related industries) and nonpecuniary aspects. Another example of such an externality is that caused by intergenerational transfers. As Nerlove states, "Evidence is accumulating that the educational attainment of the mother is among the most important determinants of a child's future academic and economic success" (1972, p. S 195). A smaller but still significant transfer passes from father to child. Neither transfer is fully appropriable, implying underinvestment in education so long as parents value benefits to their children less than benefits to themselves. The first of these mixed externalities may be quite large. For example, in many places (Boston, Palo Alto) technologically oriented firms have grown up around major universities. One point regarding intergenerational transfers is that even if they were very substantial and parents' utility functions were completely separable from those of their children, the NPV of the transfers subject to externality would probably not be very large, simply because any returns to schooling of children are realized many years after the schooling choice of the parent is made. Thus the discount factor on these returns in quite sizable.

VII. THE EDUCATIONAL SUBSIDY

Subsidy of education acts as a distortion toward "too much" educational investment. However, to the extent that distortion due to uncertainty,

"capital market imperfections," depreciation, externalities, and disequilibria cause net underinvestment in education, it is an offsetting distortion. The question of whether it exceeds or falls short of the amount required to make investment in HC optimal is important. Unfortunately, there is no easy answer. The simple expedient of comparing gross-of-tax rates of return to schooling with those on alternative investments is not correct since these rates contain risk premiums of undetermined size. Becker attempts to match after-tax rates of return on education with those on similarly risky PC assets. He finds a small relative underinvestment in education, but the difference is not large enough to exceed confidence limits (1964, Chapter V). However, his methods are subject to dispute because of his use of the variance of the rate of return as a measure of marginal risk. Since any variance must be positive, he effectively excludes the possibility that education may decrease risk. If the average increment to risk for investments in education were zero or negative, the appropriate asset with which to compare education would have a much lower rate of return. Therefore, it is probable that rates of return to schooling exceed, perhaps substantially, those on comparable PC. Note, however, that this is much less likely to be true for educational assets versus PC owned by corporations. High marginal taxes on corporate earnings mean that, in the absence of externalities, the social rate of return is $r_c = \frac{r'_c}{1-t_c}$ where r_c is the gross-of-tax rate, r'_c is net-of-tax, and t_c is the effective rate of tax on corporate capital. (See page 14.) Since, in the United States t_c is effectively greater than 50 percent, social rates on corporate PC in at least some industries probably exceed social rates of return to education.

Assuming the total amount of educational subsidy to be exogenous, another important question is whether it is appropriately allocated across different levels of schooling. My strong expectation is that this question must be answered in the negative. Various attempts to measure private rates of return to schooling show that they fall markedly as schooling level rises. (Schultz 1971a, Table 10.1, p. 173.) Although no firm statement can be made without additional evidence, I see nothing in the conversion to social rates that would change the ranking of private rates. In particular, the fact that risk falls with educational level need not be the cause of this pattern of rates, since just as rates of return are figured on marginal differences in earnings so must they be figured on marginal differences in risk. Consideration of risk would give the indicated fall in rates only if the rate of decrease in risk was larger between high school and college than between grade school and high school. In fact, my calculations show that the rate of decrease attenuates and may reverse for higher educational levels (Olson 1973b, Tables 3-5).

Taking at face value this assertion that social rates also decline with schooling level, the conclusion must be that there is "too little" subsidy of grade school education relative to, say, college education. Of course, as Schultz points out, any increased resources to grade school education could not increase quantity; rather they would be used to increase quality (1971a, p. 146).

Results of recent studies by Freeman (1973) and Welch (1972) show higher private rates of return for blacks than for whites. If my conclusion that social rates of return are also higher for blacks (1972,

Section III) is correct, this implies the appropriateness of a shift of some subsidy from white to black students.

On the ticklish question of whether current within-level allocation of subsidy is correct (between, say, engineering and English) I will venture no guess. Although calculated private money rates of return are clearly lower (perhaps even negative) for study of English, both costs and returns contain substantial nonmonetary elements.

VIII. SUMMARY AND CONCLUSION

A variety of results applicable to the economics of education and of other forms of human capital are demonstrated in this paper. Section II indicates that the only distortion due to uncertainty arises because information has attributes of a public good. In Section III, I show that under reasonable assumptions there need be no distortion attributable to "capital market imperfections." If the assumptions are violated this distortion is small and conflicting forces may even cause it to distort in a direction opposite from that normally assumed.

In Section IV, I discuss the effect of tax laws on the relative degree of distortion due to depreciation within the markets for human and physical capital and on the allocation of total investment funds between these markets. I find that within-class distortions may be smaller or larger for human capital, but that, other things equal, current tax laws push toward relatively "too much" investment in human capital. Disequilibria were discussed in Section V, where I argued that an unusual set of fixed costs (including tenured teachers) slows adjustment in the amount and allocation of educational services. The market for educational

services is in disequilibrium in the 1970s, since its structure is more nearly appropriate for the boom conditions of the 1960s.

Section VI contained a discussion of externalities in which it was demonstrated that even under very strict conditions the present value of uncaptured intergenerational transfers is small. In Section VII, I showed that examination of social rates of return to education leads to the tentative findings that (1) there is "too little" investment in education relative to physical capital and (2) within education there is "too much" investment in the higher levels.

Although further research will be necessary before these findings can be advanced with more assurance, the former has interesting implications. If true, it means that positive distortions due to differences in tax treatment, subsidies, and (probably) uncertainty are outweighed by negative distortions due to externalities, "capital market imperfections," and disequilibria. Therefore, in addition to a reshuffling of the educational subsidy among types and levels of schooling, it implies that a relative increase in the overall subsidy to education is justified.

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